# 1. Collecting Data

**Chapter Objectives**

By the end of this chapter students will be able to:

- Categorise different types of data
- Describe some different data collection methods
- Organise data in a frequency table

## 1.1 Qualitative and quantitative data

### Key words

**Qualitative** - Related to things that are described by words not by numbers

**Quantitative** - Related to things that are described by numbers

**Discrete** - Has only a fixed set of values. For example, the ages a group of people

**Continuous** - The opposite of discrete. Can take any numerical value. For example, height

Variable - Something that changes. A quantity which can take on different values

### Practice - Answers

**i.**

    **a.** Discrete

    **b.** Discrete

    **c.** Continuous

    **d.** Discrete

    **e.** Continuous

    **f.** Discrete

**ii.** Possible answers:

Discrete variables include: hair colour, eye colour, age in years, gender, number of siblings

Continuous variables include: height, length of arm, leg etc., exact age

**iii.**

    **a.** Qualitative

    **b.** Quantitative

    **c.** Qualitative

    **d.** Quantitative

    **e.** Qualitative

    **f.** Quantitative

    **g.** Qualitative

    **h.** Quantitative

    **i.** Quantitative

**iii.**

a. Discrete

b. Continuous

c. Discrete

d. Discrete

e. Discrete

f. Continuous

g. Discrete

h. Discrete

i. Continuous

**iv.** Possible answers:

a. The colour is qualitative, the quantity of petrol that can be held in the tank is quantitative

b. The type of elephant is qualitative, the number of elephants in the herd is quantitative

c. The ethnicity of the person is qualitative, the age in years of the person is quantitative

## 1.2 Sampling

Key words

**Survey** - A general examination of a situation or subject

**Population** - The total number of inhabitants in an area

**Census** - A sample that includes every member of a population

Sample - A small group of things that are taken from a larger group of things and studied so that more can be said about the larger group

Practice - Answers

a. Census

b. Census

c. Census

d. Sample

e. Sample

f. Sample

g. Sample

## 1.3 Primary and secondary data

Key words

**Primary data** - Data which we collect ourselves

**Secondary data** - Data which we use which was collected by another person or organisation

Source - The place where secondary data comes from

Practice - Answers

**i.**

a. Secondary data. Because you could get the information from the school administrator

b. Secondary data. Because you could ask the teashop for their financial records

c. Secondary data. Because many books have been written about tourism in Myanmar

d. Primary data. Because you need to ask people's opinions directly

e. Secondary data. Because there are reports available about poverty in African countries

**ii.** Possible answers:

    **c.** The internet or the Myanmar tourist office

    **e.** United Nations website

**iii.**

| Data | Advantages | Disadvantages |
|------|-----------|---------------|
| Secondary | - Cheap to collect<br>- Easy to collect | - Data may be old<br>- The data may be inaccurate |
| Primary | - You know how it was collected<br>- Can choose who to collect data from | - Takes a long time to collect<br>- Expensive to collect |

**iv.** If possible, divide the students into small groups and tell them to search the internet using www.google.com to find sources of information. Discuss the answers in the following lesson. (Please note that Google itself is not a source but is used to find sources on other websites.)

## 1.4 Methods for collecting primary data

**Key words**

**Questionnaire** - A set of written questions designed to collect data on a subject from people

**Interview** - A set of written questions designed to collect data on a subject from people

**Observation** - Collecting data by going to watch a situation

**Experiment** - A method for collecting data which involves doing tests

i. Possible answers:

**First question:**
   a. It is difficult to define 'young' and 'old'
   b. It would be better to have categories of ages such as '10-19', '20-29' etc. because the categories given are too general.

**Second question:**
   a. Hardly anyone is under 1 metre or over 2 metres
   b. People could either write down their actual height or you could use categories again - '1 to 1.2m'

**Third question:**
   a. If someone answers 'no' then you do not know their real opinion, only that they are not amazing so the information collected is not useful.
   b. More categories and a more specific question would be better, e.g. 'What is your opinion of the standard of teaching in your school? - Very good, good, fair, poor, very poor'. It would also be could to ask for an explanation of the answer, e.g. 'The teaching is good because...'

ii. Ask students to work in pairs to create their questionnaire. The content should focus on what work they would like to do, where they think they will live, choices of family life, etc.

After each group has finished their questionnaire, ask them to swap with another group so that they can give feedback on the quality of the group's questions.

Finally, create a list on the board of the best questions by discussing with the students which questions they like and why.

# 1.5 Recording data in tables

**Key words**

**Table** - A set of data presented in rows and columns. Choosing one value in the table enables another connected value to be read

**Tally** - A simple way of counting things in groups of five using lines

**Frequency** - How often something which we are studying occurs

**Frequency distribution** - A table which presents the frequencies of different events we are studying

Class **intervals** - The groups which we use to organise continuous data

**Think**

    **a.** 4 (the students should write 4 in the 'frequency column')

    **b.** On Sunday 11 students were born

    **c.** On Monday and Saturday 7 students were born

    **d.** To find this figure the students should complete the 'frequency' column and then add all the numbers to make 52

**Think**

    **a.** 30-39 years

    **b.** 90+

    **c.** 4,088,469 + 4,172,971 = 8,261,440

    **d.** This class interval is different because not many people will be over 90 years old

**Practice - Answers**

**i.**  a.

| Job | Tally | Frequency |
|---|---|---|
| Teacher | ЖЖ \|\| | 7 |
| Doctor | ЖЖ | 5 |
| Musician | \|\|\| | 3 |
| Soldier | \|\|\| | 3 |
| Nurse | \|\|\| | 3 |
| Translator | \|\|\| | 3 |
| | **TOTAL** | **24** |

    **b.** 24

    **c.** Teacher

    **d.** It is much easier to interpret and analyse the data when it is in a table

**e.**

**ii.**

   **a.**

| Age | Tally | Frequency |
|---|---|---|
| 0 - 9 | \|\|\|\| | 4 |
| 10 - 19 | 卌 \|\|\| | 8 |
| 20 - 29 | 卌 卌 \|\| | 12 |
| 30 - 39 | 卌 \|\|\| | 8 |
| 40 - 49 | \|\|\|\| | 4 |
| 50 - 59 | \|\|\|\| | 4 |
| | **TOTAL** | **40** |

   **b.** 10 years

   **c.** 8

   **d.** 12

# 2. Analysing Data

**Chapter Objectives**

By **the end of this chapter students will be able to:**

- Calculate the mean, mode and median of discrete and continuous data
- Calculate the range and interquartile range of discrete and continuous data
- Draw a scatter diagram from a table of data
- Describe the relationship between two sets of data by reading a scatter diagram

## 2.1 Mean, mode and median

**Key words**

**Average** - A number which can be used to represent a set of data

**Mean** - One kind of average. The mean is calculated by adding up all the values and dividing by the total number of values

**Mode** - One kind of average. The mode is the value which occurs most often in a data set

Median - One kind of average. The median is found by ordering the data from smallest to largest and finding the middle value

**Think**

The mean of a set of data is the <u>sum</u> of the values <u>divided</u> by the number of values.

The <u>median</u> is the <u>middle</u> value when the data is arranged in order of size.

The <u>mode</u> of a set of data is the value which occurs <u>most</u> often.

**Practice - Answers**

**i.**

    **a.** 34

    **b.** (28 + 29)/2 = 57/2 = 28.5

    **c.** 26.4

**ii.**

    **a.** There is no mode because each value occurs only once

    **b.** 3,839,000

    **c.** 4,263,328

**iii.**

    **a.** 6,471,000

    **b.** twelve million and eighty thousand

**iv.**

    **a.** 9,951,200

    **b.** The answer is that there is no mode because each value occurs only once. Explain this to the students if nobody thinks of it themselves

The set has 12 numbers so, n = 12

The total of the set is 36 so, $\Sigma X = 36$

Mean = $\Sigma X/n = 36/12 = 3$

## 2.2 Choosing an appropriate average

## 2.3 The quartiles

**Quartiles** - Numbers which divide a set of data into 4 intervals, each containing 25% of the data

**Lower quartile** - The number which is one quarter or 25% into the data set when it is arranged in numerical order

**Upper quartile** - The number which is three quarters or 75% into the data set when it is arranged in numerical order

Life **expectancy** - The number of years a person is predicted (expected) to live based on statistical analysis of a population

| Lower quartile | $\left(\dfrac{n+1}{2}\right)$ th Value |
|---|---|
| Median | $\dfrac{3(n+1)}{4}$ th Value |
| Upper quartile | $\left(\dfrac{n+1}{4}\right)$ th Value |

In order the populations are:

>1,145,000   1,581,082   3,083,000   3,839,000   4,082,000   5,882,000   10,231,271

  **a.** Lower quartile = (n + 1)/4 th value = 8/4 = 2nd value = 1,581,082

  **b.** Upper quartile = 3(n + 1)/4 th value = 24/4 = 6 th value = 5,882,000

## 2.4 The range and interquartile range

**Key words**

**Range** - The difference between the largest and smallest pieces of a data set

Interquartile **range** - The difference between the upper quartile and lower quartile of a data set

**Practice - Answers**

**i.**

The lowest value is 63.1 and the highest is 76.8 so the range = 76.8 - 63.1 = 13.7 years

The lower quartile is 71 years and the upper quartile is 75.7 years so the Interquartile range = 4.7 years

**ii.**

The lowest value is 1,145,000 and the highest is 10,231,217 so:

>Range = 10,231,217 - 1,145,000 = 9,086,217

The lower quartile is 1,581,082 and the upper quartile is 5,882,000 so:

>Interquartile range = 5,882,000 - 1,581,082 = 4,300,918

## 2.5 Averages from frequency distributions

**i.**

    **a.**

| Number of goals (x) | Frequency (f) | fx |
|:---:|:---:|:---:|
| 0 | 4 | 0 |
| 1 | 11 | 11 |
| 2 | 8 | 16 |
| 3 | 6 | 18 |
| 4 | 1 | 4 |
| 5 | 0 | 0 |
| 6 | 0 | 0 |
| 7 | 1 | 7 |
| | Σf = 31 | Σf x = 56 |

    **b.** Using the formula the mean = 56/31 = 1.81 goals per game

**ii.**

| Number of people (x) | Frequency (f) | fx |
|:---:|:---:|:---:|
| 2 | 4 | 8 |
| 3 | 11 | 33 |
| 4 | 8 | 32 |
| 5 | 6 | 30 |
| 6 | 3 | 18 |
| 7 | 2 | 14 |
| 8 | 0 | 0 |
| 9 | 2 | 18 |
| | Σf = 36 | Σf x = 153 |

The mean = 153/36 = 4.25 people per household

## 2.6 Averages from grouped data

**Practice - Answers**

i.

a.

| Age | Frequency (f) | Middle value (x) | fx |
|---|---|---|---|
| 0 - 9 | 2 | 4.5 | 9 |
| 10 - 19 | 4 | 14.5 | 58 |
| 20 - 29 | 12 | 24.5 | 294 |
| 30 - 39 | 5 | 34.5 | 172.5 |
| 40 - 49 | 2 | 44.5 | 89 |
| **Total  (Σf)** | **25** | **Total (Σfx)** | **622.5** |

**b.** The mean = Σf x / Σf  = 622.5 / 25 = 24.9

**ii.**

**a.**

| Age | Frequency (*f*) | Middle value (*x*) | *fx* |
|---|---|---|---|
| 1 - 5 | 2 | 3 | 6 |
| 6 - 10 | 9 | 8 | 72 |
| 11 -15 | 3 | 13 | 39 |
| 16 - 20 | 1 | 18 | 18 |
| **Total (Σ*f*)** | **15** | **Total (Σ*fx*)** | **135** |

The mean = Σf x / Σf  = 135 / 15 = 9

**b.**

| Age | Frequency (*f*) | Middle value (*x*) | *fx* |
|---|---|---|---|
| 10 - 19 | 8 | 14.5 | 116 |
| 20 - 29 | 11 | 24.5 | 269.5 |
| 30 - 39 | 13 | 34.5 | 448.5 |
| 40 - 49 | 9 | 44.5 | 400.5 |
| 50 - 59 | 7 | 54.5 | 381.5 |
| **Total  (Σ*f*)** | **48** | **Total (Σ*fx*)** | **1616** |

The mean = Σf x / Σf  = 1616 / 48 = 33.7

**c.**

| Age | Frequency (*f*) | Middle value (*x*) | *fx* |
|---|---|---|---|
| 10 -12 | 1 | 11 | 11 |
| 12 - 14 | 5 | 13 | 65 |
| 14 - 16 | 12 | 15 | 180 |
| 16 - 18 | 3 | 17 | 51 |
| 18 - 20 | 0 | 19 | 0 |
| **Total (Σ*f*)** | **21** | **Total (Σ*fx*)** | **307** |

The mean = Σf x / Σf  = 307 / 21 = 14.6

## 2.7 Scatter diagrams

**Key words**

**Scatter diagram** - A graph which is used to present statistical data about two variables. The graph can be used to find relationships between the two variables

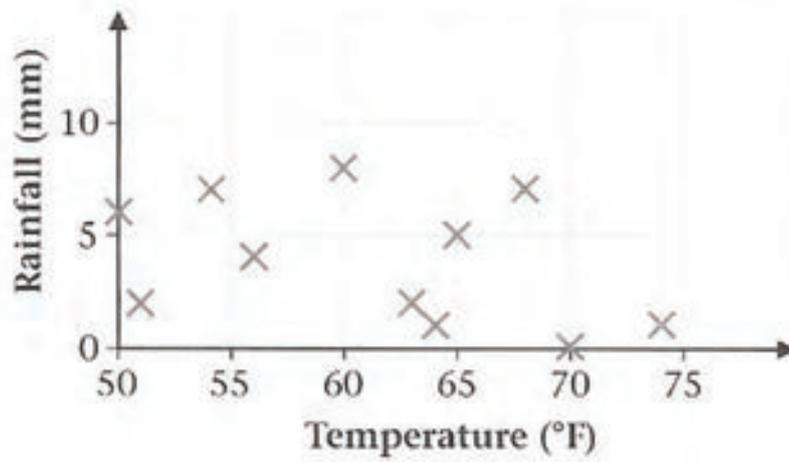**Correlation** - A measure of the relationship between two sets of data

**Positive correlation** - If the values in two sets of data increase or decrease at the same time then they have a positive correlation

**Negative correlation** - If the value of one set of data decreases as the other increases then the two sets of data have a negative correlation

**i.** The answer is quite easy: More drinks are sold when it is hotter because people are hotter!

**ii.** Yes, there is a relationship. The longer Chandra drives the less distance is remaining.

**iii.**

**a.**



**b.** The scatter diagram doesn't show a relationship between the temperature and the amount of rain.

i. There is a <u>positive</u> correlation between the average daily temperature and the number of cold drinks sold, because as the temperature <u>increases</u> the number of cold drinks sold <u>increases</u>. There is a <u>negative</u> correlation between the time spent driving and the distance remaining, because as the time <u>increases</u> the distance remaining <u>decreases</u>.

**Practice - Answers**

i.

   a.

**A comparison of maximum temperature and number of hours of sunshine**
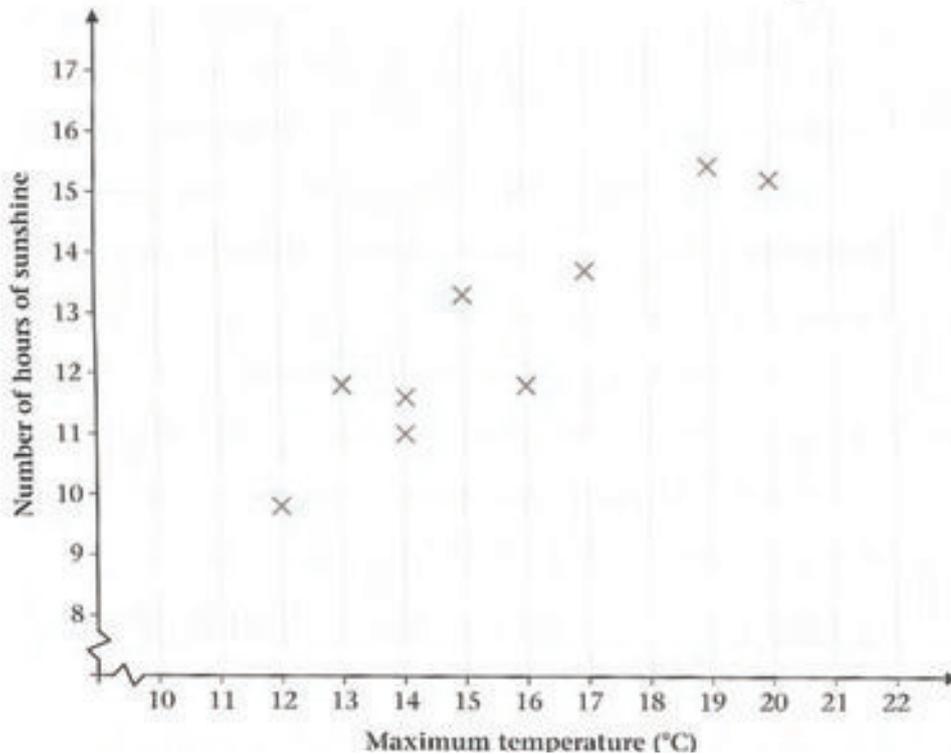


   b. There is a positive correlation between the  hours of sunshine and the maximum temperature, because as the hours increase the temperature increases.

**ii.**

    **a.** Check the students' scatter diagrams. Make sure the students label the axes and give the graph a title.

    **b.** Ask the students whether there is a relationship between the area and population of a country. The correct answer is that there is no relationship.

# 3. Presenting Data

**Chapter Objectives**

**By the end of this chapter students will be able to:**

- Draw pie charts and bar graphs to present discrete data
- Extract information from pie charts and bar graphs to provide information about data
- Draw histograms and cumulative frequency polygons to present continuous data
- Extract information from histograms and cumulative frequency polygons to provide information about data
- Calculate the range and interquartile range of data by reading a cumulative frequency polygon

## 3.1 Introduction

**Key words**

**Diagram** - A picture which is designed to show how something works or how the relationship between the parts works

**Pie charts** - A way of showing information using different sized sectors of a circle. The sectors look like slices of a pie

**Bar graph/bar chart** - A diagram which uses horizontal or vertical bars of equal width to represent frequency

**Histogram** - A type of bar graph which represents grouped continuous data

**Cumulative frequency** - The number of occurences of something at or before a given point

Cumulative frequency graph - A graph which shows the cumulative frequency plotted against values of another variable

**Think**

a. Ask students to make a list. If they can't think of anything ask them to look around their environment after school. Ask students to explain the diagrams and what was being shown.

b. Discuss students ideas on why we use diagrams to present data. The most obvious answer is that they are easy to look at and understand compared to lists of unorganised data.
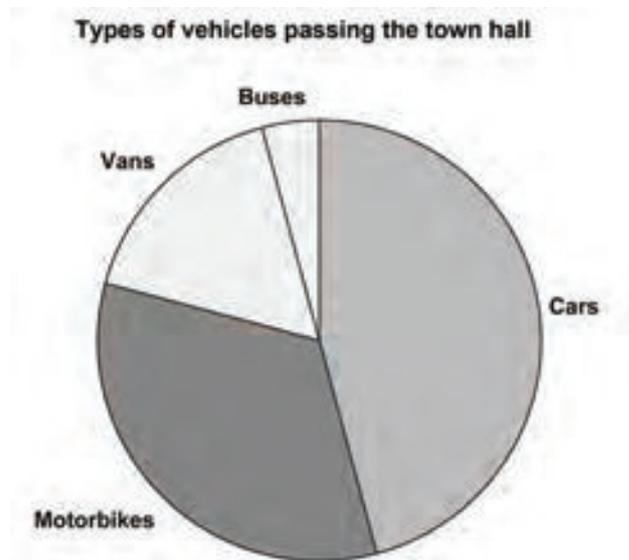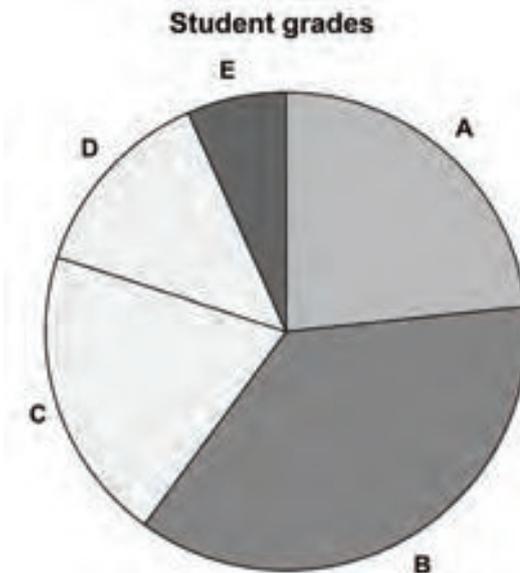
# 3.2 Pie Charts

**Practice - Answers**

i.

  **a.**

| Type of vehicle | Number of vehicles | Calculation | Degrees of circle |
|---|---|---|---|
| Cars | 110 | (110/240)*360 | 165 |
| Motorbikes | 80 | (80/240)*360 | 120 |
| Vans | 40 | (40/240)*360 | 60 |
| Buses | 10 | (10/240)*360 | 15 |

  **b.**

Types of vehicles passing the town hall

ii.

Student grades

iii. **a.** Bus   **b.** One quarter   **c.** 6 x 4 = 24   **d.** 2   **e.** 4

# 3.3 Bar Graphs

**Practice - Answers**

**i.**

    **a.** Possible answer: 'Number of peas per pod against frequency'.

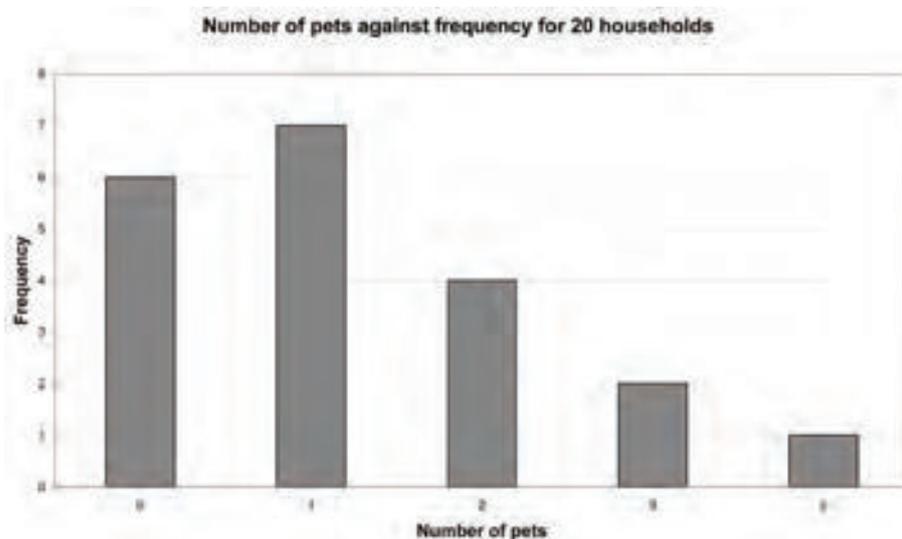    **b.** The modal value is 6 as this is the number of peas in a pod with the highest frequency

**ii.**



Number of goals scored against frequency

**iii.**
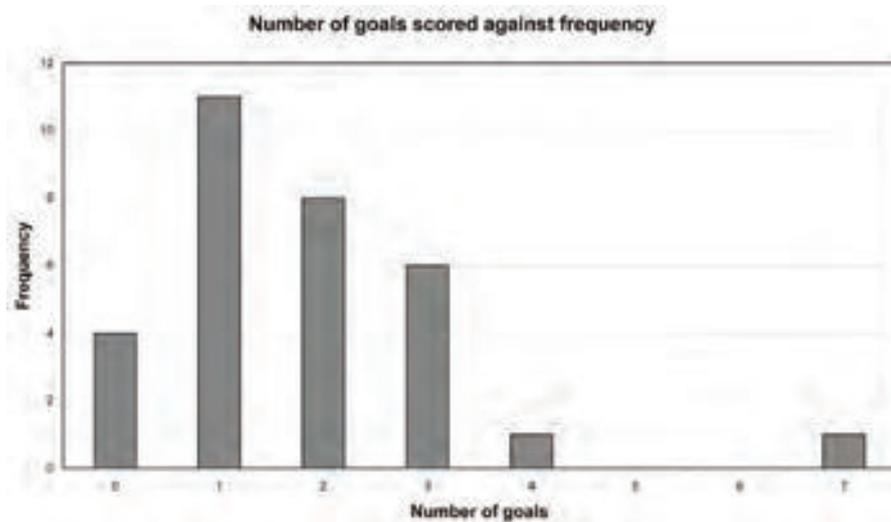
    **a.** The data is discrete as animals are counted by whole numbers only.

    **b.**

| Number of pets | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Frequency | 6 | 7 | 4 | 2 | 1 |

    **c.**



Number of pets against frequency for 20 households

    **d.** 6 out of 20 households had no pets. This is 30 %. 3 out of 20 households had 3 or more pets. This is 15 %

**iv.** **a.** 50    **b.** 15    **c.** 36%

Answers continued on the next page.

**v.**

**a.**

| Number of peas in a pod | Tally | Frequency |
|---|---|---|
| 3 | IIII | 4 |
| 4 | IIII IIII III | 13 |
| 5 | IIII IIII I | 11 |
| 6 | IIII IIII IIII IIII IIII III | 28 |
| 7 | IIII IIII IIII IIII IIII IIII IIII IIII IIII III | 48 |
| 8 | IIII IIII IIII IIII IIII II | 27 |
| 9 | IIII IIII IIII IIII IIII IIII | 29 |
| 10 | IIII IIII IIII | 4 |
| 11 | IIII | 1 |
| 12 | I | 0 |
| 13 | I | 1 |

**b.**



Number of peas in a pod against frequency

**c.** If we compare this graph with the graph on page 23 we can say that fertiliser increases the number of peas for several reasons: the mode is higher, the minimum number of peas in a pod is higher and the highest number of peas in a pod is higher.

## 3.4 Multiple bar graphs

Key words

Multiple **bar graph** - A bar graph which shows two or more sets of data together so that they can be compared

Think

**a.** Subjects studied by first year students   **b.** 64   **c.** 74   **d.** 38   **e.** Arts   **f.** 360

## Practice - Answers

**i.**

    **a.** August

    **b.** September

    **c.** October

    **d.** 35

    **e.** 40

    **f.** September

    **g.** 190

**ii.**

    **a.** Males

| Age in years | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Frequency | 2 | 5 | 7 | 0 | 4 |

    Females

| Age in years | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Frequency | 6 | 4 | 0 | 2 | 2 |

    **b.**



Age of male and female patients against frequency
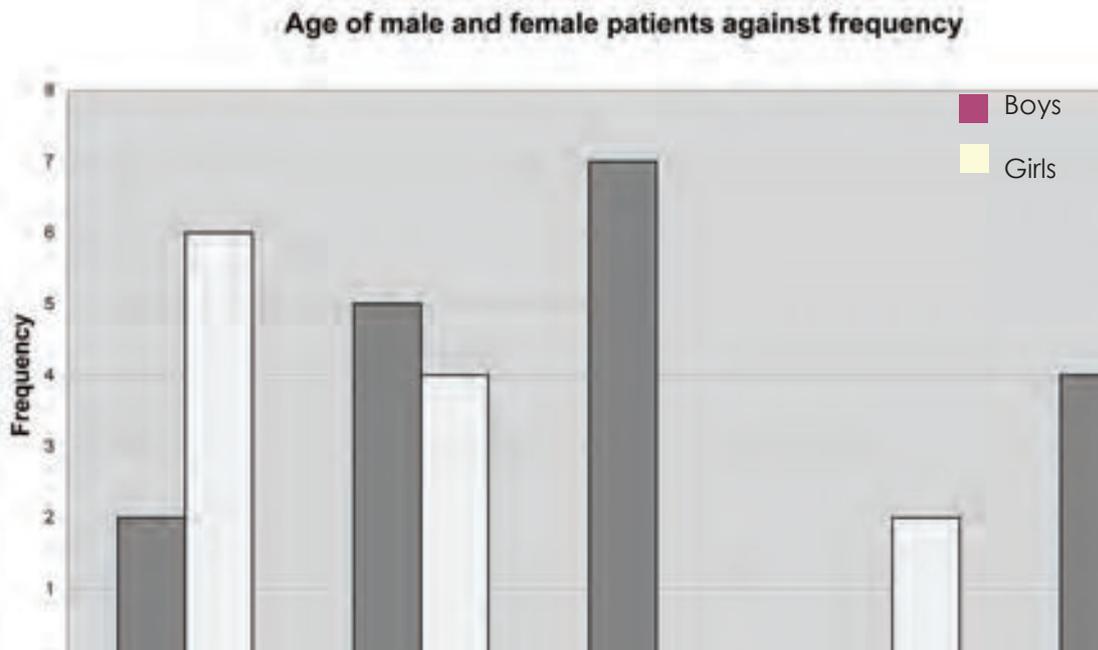
    **c.** Possible answers:

The dark columns represent _____.The age with the highest number of patients for boys was _____. In total there were _____ girls. There were more _____ than _____.

## 3.5 Histograms

## Practice - Answers

**i.** Possible answer: Heights of people in Verti village

**ii.** .
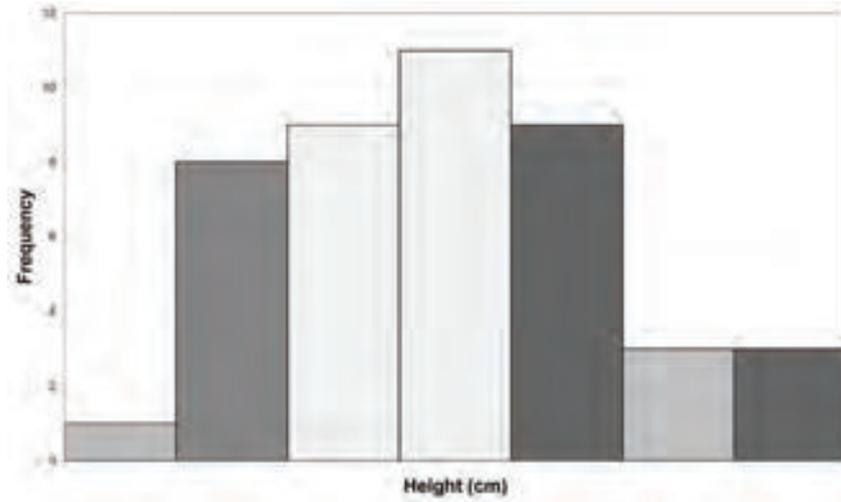
**iii.**

    **a.** Weight is a continuous measurement as it can take any value: 1, 1.5, 1.55, 1.555 etc.

    **b.**

| Weight (kg) (W) | Frequency |
|---|---|
| $0 \leq W < 1$ | 2 |
| $1 \leq W < 2$ | 5 |
| $2 \leq W < 3$ | 4 |
| $3 \leq W < 4$ | 2 |
| $4 \leq W < 5$ | 4 |

    **c.**
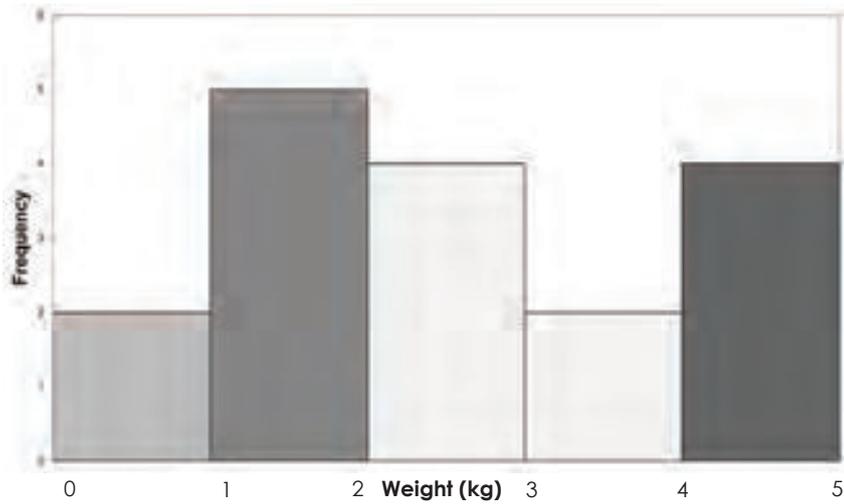


**iv.**

    **a.**

| Height (cm) (h) | Frequency |
|---|---|
| $110 \leq h < 115$ | 3 |
| $115 \leq h < 120$ | 4 |
| $120 \leq h < 125$ | 5 |
| $125 \leq h < 130$ | 7 |
| $130 \leq h < 135$ | 10 |

    **b.**
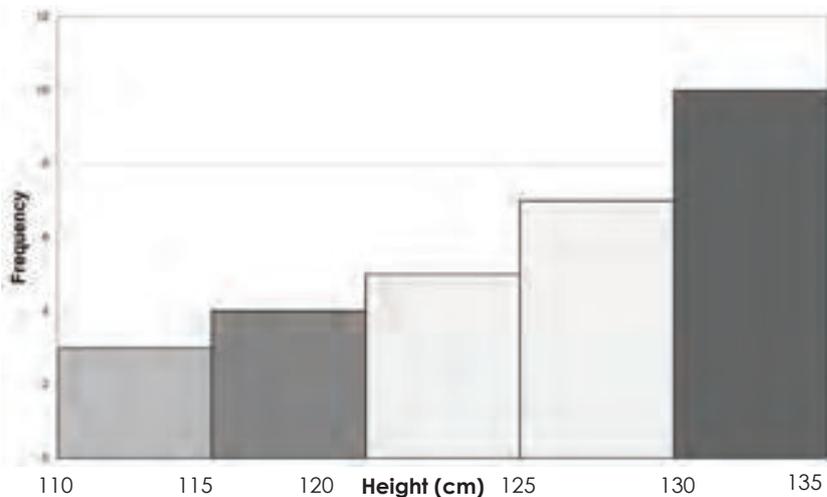


## 3.6 Cumulative frequency

## Practice - Answers

a.

| Time listening to the radio (hours) | Frequency |
|---|---|
| 0 - 3 | 3 |
| 0 - 7 | 8 |
| 0 - 11 | 16 |
| 0 - 15 | 19 |
| 0 - 18 | 20 |

b.

| Number of students in the class | Frequency |
|---|---|
| 0 - 5 | 8 |
| 0 - 10 | 15 |
| 0 - 15 | 24 |
| 0 - 20 | 31 |
| 0 - 25 | 40 |

c.

| Age of mother at birth of baby (years) | Frequency |
|---|---|
| 16 - 20 | 3 |
| 16 - 25 | 9 |
| 16 - 30 | 26 |
| 16 - 35 | 52 |
| 16 - 40 | 63 |
| 16 - 45 | 65 |

d.

| Daily temperature (°C) | Frequency |
|---|---|
| $-10 \leq t < 0$ | 12 |
| $-10 \leq t < 10$ | 98 |
| $-10 \leq t < 20$ | 283 |
| $-10 \leq t < 30$ | 362 |
| $-10 \leq t < 40$ | 365 |

# 3.7 Cumulative frequency graphs

**Practice - Answers**

a.

**Number of people against time listening to the radio**

b.

**Number of students in each class against number of classes**

c.

**Age of mother at baby's birth against number of births**

d.

**Daily temperature against number of days**
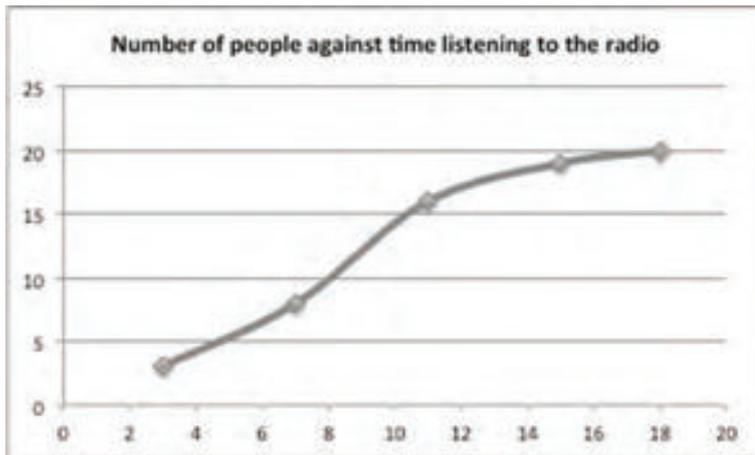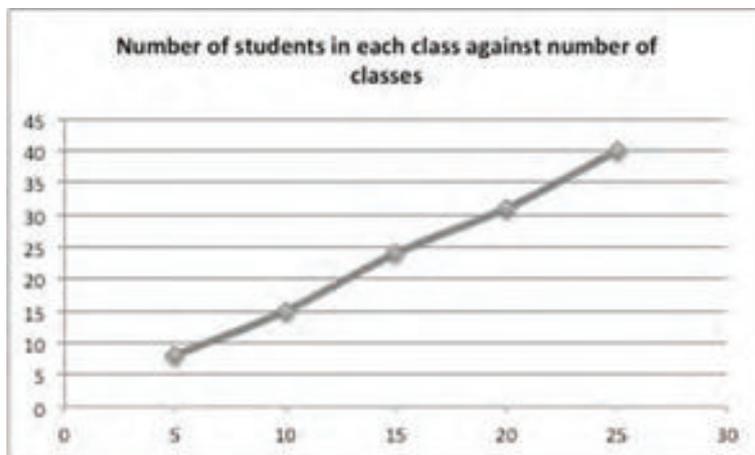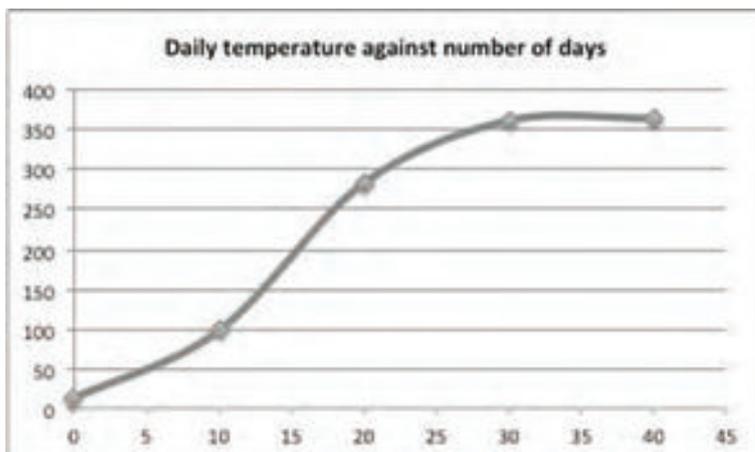
# 3.8 Spread from cumulative frequency graphs

## Practice - Answers

i.  1

a.

| Number of particles | Cum. Freq. |
|---|---|
| 0 - 50 | 10 |
| 0 - 100 | 26 |
| 0 - 150 | 39 |
| 0 - 200 | 50 |
| 0 - 250 | 57 |
| 0 - 300 | 60 |

b.
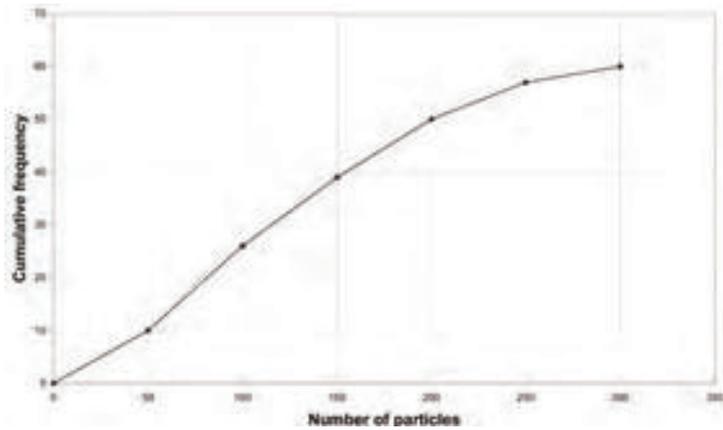


c. 115          d. 66  and 177          e. 111

2.

a.

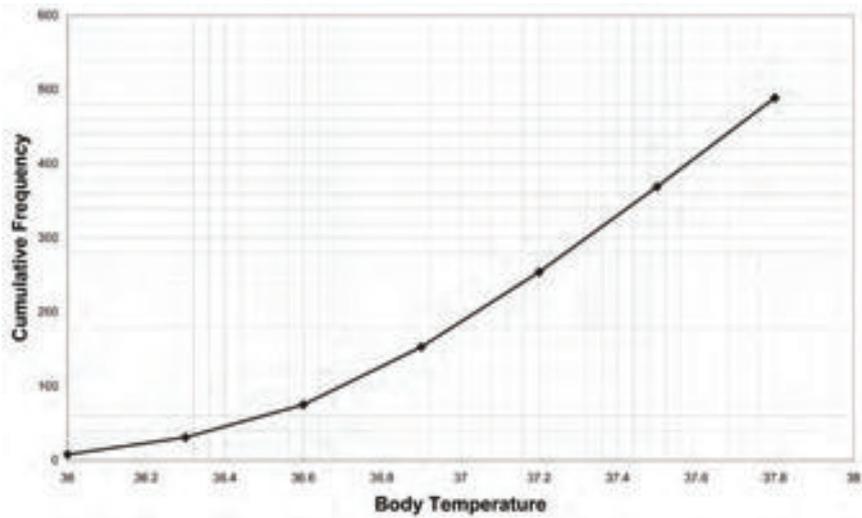| Age of company employee (years) | Cum. Freq. |
|---|---|
| $16 < a \leq 20$ | 6 |
| $16 < a \leq 25$ | 15 |
| $16 < a \leq 30$ | 29 |
| $16 < a \leq 35$ | 33 |
| $16 < a \leq 40$ | 35 |
| $16 < a \leq 45$ | 36 |

b.
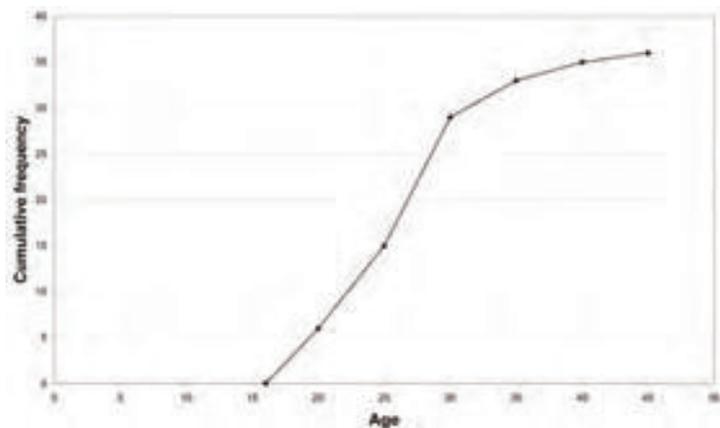


c. 26 years     d. 22 years and 29 years     e. 7 years

**ii.**

To answer this question students should draw a cumulative frequency table and graph. They can then use the graph to find the answers:



a. 6.75° C

b. 0.65° C

c. 86 people

# 4. Probability

**Chapter Objectives**

By the end of this chapter students will be able to:

- Describe the probability of an event occuring in words
- Calculate the probability of a single event using a formula
- Calculate the probability of more than one event using a formula
- Draw a sample space to show all possible outcomes of events involving more than one object
- Calculate probabilities by reading information in a sample space
- Calculate probabilities by reading probability trees
- Draw probability trees to show all possible outcomes of two or more independent events
- Calculate probabilities of two or more dependent events using probability trees

## 4.1 Finding probabilities

**Key words**

**Probability** - A measure of how likely something is to happen. Usually represented as a number between 0 and 1

**Event** - Something which may or may not happen

**Impossible** - Describes something which definitely will not happen

**Certain** - Describes something which will definitely happen

**Likely** - Describes something which has a high probability (chance) of happening

Unlikely - Describes something which has a low probability (chance) of happening

**Practice - Answers**

**i.** There are an infinite number of answers to this questions. Tell students they can write anything provided they can give a reason for the event being impossible, certain or in between.

**ii.**

    **a.** certain

    **b.** impossible

    **c.** unlikely

**Practice - Answers**

i.

    **a.** 1/6

    **b.** 3/6

    **c.** 2/6

    **d.** 5/6

ii.

    **a.** 3/10

    **b.** 8/10

iii.

    **a.** 26/52

    **b.** 26/52

    **c.** 13/52

    **d.** 4/52

    **e.** 2/52

**iv.**

    **a.** 3

    **b.** red

    **c.** There are 2 chances of getting red, whereas there is only 1 blue and 1 yellow chance. Using probability we have P(red) = 2/4, P(blue) = P(yellow) = 1/4. The probability of getting red is higher so it is better to choose red.

**v.**

| Event | Probability | | |
|---|---|---|---|
| | **Fraction** | **Decimal** | **Percentage** |
| A newborn baby is a boy | 1/2 | 0.5 | 50 % |
| Rolling a dice and getting an even number | 3/6 | 0.5 | 50 % |
| Spinning the spinner in iv. and getting blue | 1/4 | 0.25 | 25 % |
| Pulling a red card from a pack of cards | 26/52 | 0.5 | 50 % |

## 4.2 More than one event

**Key words**

**Mutually exclusive** - Events which cannot happen at the same time are said to be mutually exclusive

Sample **space** - The set of all possible outcomes of experiments involving more than one object

## Think

**a.** P(green) = 3/10 because there are 10 counters in total and 3 of them are green. The probability of getting green is 3 out of 10 or 3/10.

**b.** t is not possible to choose a red counter and a green counter at the same time.

**c.** There are only 3 different colours so if the counter is not yellow then it also has to be either green or red, meaning P(not yellow) = P(red or green).

**d.** The total probability is equal to 1 and P(not yellow) + P(yellow) includes all possible outcomes, so P(not yellow) + P(yellow) = 1 which is the same as P(not yellow) = 1 - P(yellow).

## Practice - Answers

**a.** There are 52 cards in a pack and there are 4 tens and 4 aces so P(ace or ten) = 8/52

**b.** There are 52 cards in a pack and there are 26 black cards and 26 red cards

**c.** P(black or two) = 52/52 = 1 There are 52 cards in a pack and there are 4 aces, 4 tens and 4 nines so P(ace or ten or nine) = 12/52

**d.** There are 52 cards in a pack and there are 2 black kings and 2 red jacks so P (black king or red jack) = 4/52

**i.**

    **a.** 4

    **b.** P(2 girls) = 0.25

    **c.** P(2 boys) = 1/4

    **d.** P(1 girl and 1 boy) = 2/4

    **e.** Complete the sentence:

A woman is more likely to have <u>1 girl and 1 boy</u> than <u>2 boys or 2 girls</u>.

    **f.** P(Twins are the same sex) = P(2 girls) + P(2 boys) = 2/4

**ii.**

    **a.**

| + | 1 | 3 | 5 | 7 |
|---|---|---|---|---|
| **2** | 3 | 5 | 7 | 9 |
| **4** | 5 | 7 | 9 | 11 |
| **6** | 7 | 9 | 11 | 13 |
| **8** | 9 | 11 | 13 | 15 |

    **b.** The total number of outcomes is 16. The number of outcomes with score 11 is 3 so P(11) = 3/16

    **c.** The total number of outcomes is 16. The number of outcomes with score more than 10 is 6 so P(11) = 6/16

    **d.** The total number of outcomes is 16. The number of outcomes with a prime number score is 11 so P(prime number) = 11/16

    **e.** The total number of outcomes is 16. The number of outcomes with score which is a multiple of 3 is 6 so P(multiple of 3) = 6/16

## 4.3 Tree diagrams

**Key words**

Tree **diagrams** - A type of diagrams used to show the different outcomes that can happen as a result of a sequence of events.
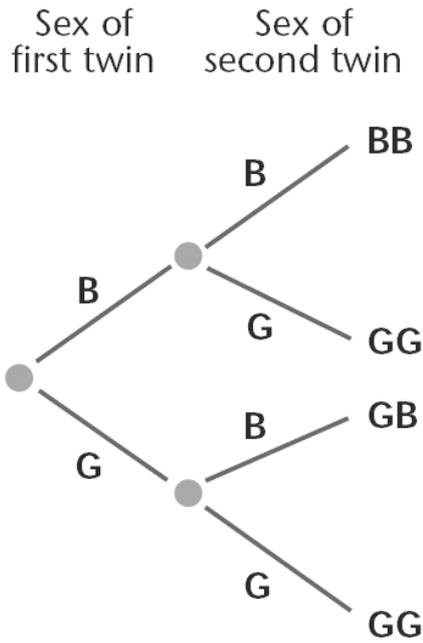
**i.**

   **a.** 4

   **b.** b. 1/4

   **c.** c. 1/4

   **d.** d. 2/4 = 1/2

**ii.**

|   | **H** | **T** |
|---|-------|-------|
| **H** | HH | TH |
| **T** | HT | TT |

**iii.**

Sex of first twin     Sex of second twin



**iv.**

   **a.**
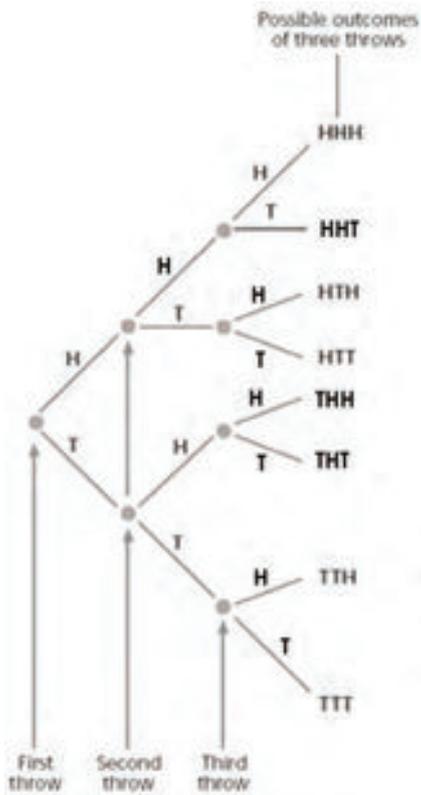


**b.** 8

**c.** 1

**d.** 1/2 * 1/2 * 1/2 = 1/8

**e.** (1/2 * 1/2 * 1/2) + (1/2 * 1/2 * 1/2) + (1/2 * 1/2 * 1/2)= 3/8

**f.** (1/2 * 1/2 * 1/2) + (1/2 * 1/2 * 1/2) + (1/2 * 1/2 * 1/2)= 3/8

**g.** 1/2

**h.** 1/4

**i.** 1/8

**j.** The pattern is that the denominator doubles with each flip of the coin (because it is multiplied by 2). The probability of getting 4 heads in four flips is 1/16.

# 4.4 Dependent and Independent events

## Key words

**Dependent event** - An event whose outcome depends on the outcome of previous events

Independent event - An event whose outcome does not depend on the outcome of previous events.
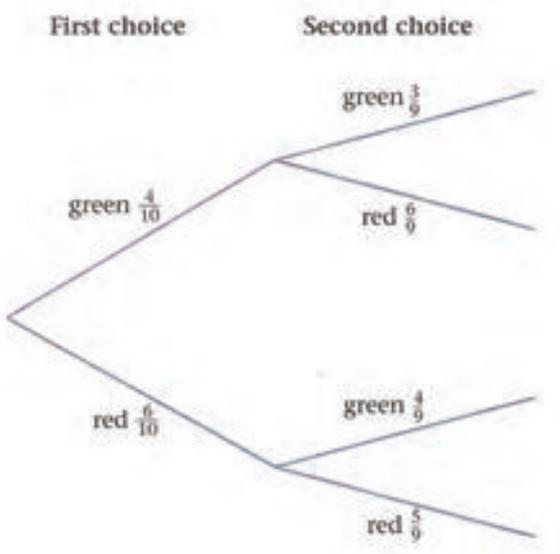
## Practice - Answers

**i.**

    **a.** 3/8 * 3/8 = 9/64

    **b.** 3/8 * 2/7 = 6/56

**ii.**

    **a.**



    **b.** 6/10 * 5/9 = 30/90

**iii.**

    **a.** 2/7 * 1/6 * 0 = 0 (there are only two male cats)

    **b.** 5/7 * 4/6 * 3/5 = 60/210

    **c.** P(2 males) = P(MMF) + P(FMM) + P(MFM)= (2/7 * 1/6 * 5/5) + (5/7 * 2/6 *1/5) + (2/7 * 5/6 * 1/5)= 10/210 + 10/210 + 10/210 = 30/210
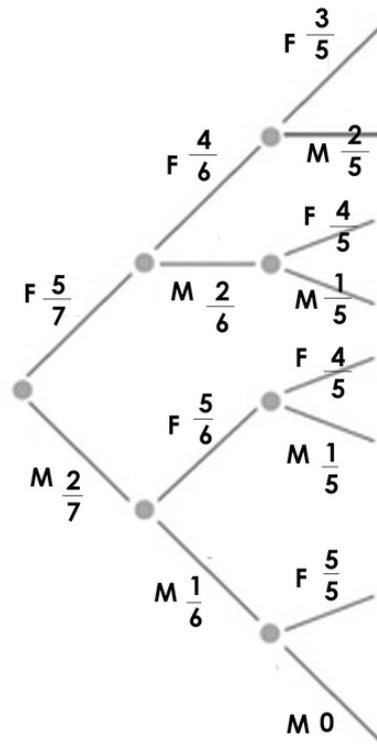
# Glossary of Keywords

The Glossary in the Student's Book is a list of all mathematical words that appear in the module. They are given in the order that they appear.

The following short activities are added to this guide to help students remember mathematical vocabulary. They can be used in several ways: to test prior knowledge of a topic, as warm-up activities at the beginning of a lesson or to review what has been learnt at the end of a topic.

## Activity 1 - Discuss questions in pairs.

Students are given questions to discuss that relate to a topic.

**Example questions** -

What is an improper fraction?

How do I change from milligrams to tonnes?

How do I find the perimeter of a square?

What is the commutative law?

What is the order of operations?

## Activity 2 - True or false.

Students work in pairs to decide if statements about a topic are true or false.

**Example for fractions** -

The denominator is the top number in a fraction.

The numerator is less than the denominator in an improper fraction.

Equivalent fractions have the same numerator

## Activity 3 - Give an explanation.

Students work in pairs to prepare a short explanation to questions. Ask some students to give their explanation to the class.

**Examples** -

Explain how to change from a mixed number to an improper fraction.

Explain how to calculate: (2 + 3) x (7 - 42)3

Explain the mistake in this statement.

Explain what a negative number is.

## Activity 4 - Brainstorming

Write a topic on the board and ask students what they know about the topic. Write their answers on the board.

## Activity 5 - What's the topic?

Write words linked to a topic on the board and ask students if they can guess the topic.

# Assessment

This is assessment covers most of the topics in this module and should give you an idea of how much the students have understood. It is recommended that you give it as a class test, with some time for review and revision beforehand.

Students will need a protractor to answer question 5 and 12 in part 2.

The total mark for each question is given on the right hand side of the page.

## Part 1 - Answers

Each question in part 1 is worth 1 mark

**a.** continuous      **b.** secondary      **c.** median      **d.** mode      **e.** scatter diagram

**f.** correlation      **g.** discrete      **h.** probability      **i.** certain      **j.** independent

**Total for part 1: 10 marks**

## Part 2 - Answers

1.

    **a.** 40

    **b.** 25

    **c.** There are 100 people in total so the number of people who said the UK is

$$100 - (40 + 25 + 5 + 10) = 20$$

    **d.** Check the students bar graphs for accuracy

**6 marks**

**2.**

| Word | Probability |
|---|---|
| Impossible | 0 |
| Likely | 0.75 |
| Certain | 1 |
| Unlikely | 0.25 |
| Even chance | 0.5 |

**3 marks**

**3.**

   **a.** 13

   **b.** (6 + 8)/2 = 7

   **c.** 7.66

   **d.** No because no data value occurs more than once

**6 marks**

**4.** Check the graphs for accuracy. They lose a mark if they didn't give the graph a title.

**3 marks**

**5.**

    **a.** 1/6

    **b.** 3/6

    **c.**

|   | **1** | **2** | **3** | **4** | **5** | **6** |
|---|---|---|---|---|---|---|
| **0** | 0 | 0 | 0 | 0 | 0 | 0 |
| **1** | 1 | 2 | 3 | 4 | 5 | 6 |
| **2** | 2 | 4 | 6 | 8 | 10 | 12 |
| **3** | 3 | 6 | 8 | 12 | 15 | 18 |
| **4** | 4 | 8 | 12 | 16 | 20 | 24 |
| **5** | 5 | 10 | 15 | 20 | 25 | 30 |

    **d.** There are 36 possible outcomes and 9 outcomes which have a score of 15 or more. So, P(15 or more) = 9/36 = 1/4

                                                                        **6 marks**

**6.**

    **a.** Check the students diagrams for accuracy. They lose a mark if they didn't label the axes and give the graph a title.

    **b.** There is no correlation between the two sets of data.

                                                                        **3 marks**

**7.**

**a.**

| Type of school | Number | Angle on Pie Chart |
|---|---|---|
| Primary | 63 | 168 |
| Comprehensive | 45 | 120 |
| Grammar | 18 | 48 |
| Others | 9 | 24 |
| Total | 135 | 360 |

**b.** Check the students pie charts for accuracy. They lose a mark if they didn't give the chart a title.

**3 marks**

**8.** Check the students bar charts for accuracy. They lose a mark if they didn't give the chart a title.

**4 marks**

**9.**

   **a.**

| Time | Frequency (*f*) | Middle value (*x*) | *fx* |
|---|---|---|---|
| 0 < t ≤ 20 | 6 | 10 | 60 |
| 20 < t ≤ 40 | 18 | 30 | 540 |
| 40 < t ≤ 60 | 30 | 50 | 1500 |
| 60 < t ≤ 80 | 9 | 70 | 610 |
| 80 < t ≤ 100 | 12 | 90 | 1080 |
| **Total  (Σ*f*)** | **75** | **Total (Σ*fx*)** | **3790** |

So, mean = Σfx/ Σf = 3790/75 = 50.5 minutes or 50 minutes and 30 seconds      **5 marks**

   **b.** Check the students histograms for accuracy. They lose a mark if they didn't give
      the chart a title.

                                                             **3 marks**

**10.**

    **a.** Check the students polygons for accuracy. They lose a mark if they didn't give the chart a title.

    **b.** 80 or 80.5

    **c.** The lower quartile is around 8 and the upper quartile is 17.5 so the interquartile range is 9.5. (Remember that the answers to b) and c) are estimates so small differences to the answers here are acceptable.)

**7 marks**

**11.**

   **a.** The gaps on the graph should be completed with Wet = 1/4, Dry = 3/4, fails to reach the top on a dry day = 1/5 and fails to reach the top on a wet day = 9/10

   **b.** b) 1/4 x 1/10 = 1/40

   **c.** P(reaching the top on a random day) = P(reaching the top on a wet day) + P(reaching the top on a dry day) = (1/4 x 1/10) + (3/4 x 4/5) = 1/40 + 12/20 = 25/40 = 5/8

**6 marks**

**12.** Students should create the table below and then use it to draw a pie chart. Check the pie charts for accuracy. They lose a mark if they didn't give the chart a title.

| Type of school | Number | Angle on Pie Chart |
|---|---|---|
| Defenders | 9 | 54 |
| Midfielders | 12 | 72 |
| Attackers | 39 | 234 |
| Total | 60 | 360 |

**3 marks**